Fiberassign performance

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Abstract

In this document I use DR7 data to calculate the conditions under which fiberassign meets the desired performance in terms of total fiber usage and number of calibration targets. The places where these metrics are not met is due to the low number of calibration targets (sky or standard stars). Taking into account the current variability of number densities for calibration and science targets across DR7 only 47% of the 7054 tiles meet all the requirements. The recomendation is to increase the number of standards above 290 locations per tile and good sky locations above 18500 per tile.

1 Introduction

fiberassign is the software that computes the assignment of fibers to DESI targets.

The following are the minimal requirements on its performance

- Fiber assignment uses required fraction of fibers IN.DAT-7002

- Fiber assignment provides sufficient calibration fibers IN.DAT-7003

In this document I present the results of running fiberassign on targets from DR7 to demonstrate how the two requirements mentioned above are met. Furthermore I list some computational performance results to understand how long does it take to run the code and how many resources does it use.

2 Software and input data

For this report I use tag 0.10.1 of fiberassign.

The input targetting data comes from DR7. On NERSC the files can be found here: `/project/projectdirs/desi/target/catalogs/dr7.1/PR372/`

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The targeting files need to be prepared in order to pass them to fiberassign. The code that prepares the data and runs fiberassign can be found here: `https://github.com/forero/fiberassign_explore/blob/master/py/fiberassign_on_DR7.py`. The script needs to be executed as `python fiberassign_on_DR7.py --program dark --size large` to produce the outputs analized in this report.

The most important features to highlight about fiberassign are the following:

- It receives as input three files: a list of science targets, a list of good sky locations and a list of standard stars.

- The code fills up to 400 sky fibers and 100 std fibers if the number density of those calibration targets is high enough.

- Afterwards the code proceeds to assign science targets.

- If there are unused fibers after the science assignment process those fibers are filled with sky targets if available.

- There are also BADSKY locations that are treated as another science target with the lowest priority.

3   Results

We only use targets that can be observed in dark time. With this restriction we end up with 7054 DESI tiles that correspond to dark time and overlap with the DR7.1 footprint. This selection returns 36M targets, 1.3M standard stars and 22M sky locations.

Upper panel in Figure 1 shows the location of all tiles that use all fibers, lower panel shows the tiles that use less than 5000 fibers. Only 3374 tiles (less than half) use all its fibers, the remaining 3680 tiles use varying number of fibers: from a few hundreds to 4999.

The regions at high declination use a low fraction of fibers due to a low number of targets. This case is ilustrated in Figure 2. However, there is a large fraction of tiles with numbers of $\approx$ 4990 fibers used. Figure 3 illustrates this case where most of the fibers go to clustered BADSKY locations, this indicates that there are not enough SKY and science targets to fill up the fibers.

Figures 4 and 5 show the regions with usages above and below the expected values for SKY and STD fibers. For SKY 6208 tiles meet the requirements, while for STD 5896 tiles meet the requirements. The number of tiles meeting both requirements is 5853, that is 82% of the tiles. The number of tiles meeting the SKY+STD requirements and using all the fibers is 3359, that is 47% of the tiles.

Figures 6 and 7 show the number of STD/SKY fibers in a tile as a function of the STD/SKY density, respectively. These Figures show that the minimal number of STD targets required not to miss the performance goal is 290 standards per tile, while for SKY locations the minimum is 9300 per tile.

We also find that in locations with science densities above 30000 targets per tile and 290 STD targets per tile, the sky locations must be higher than 18500 to achieve full usage of all fibers.
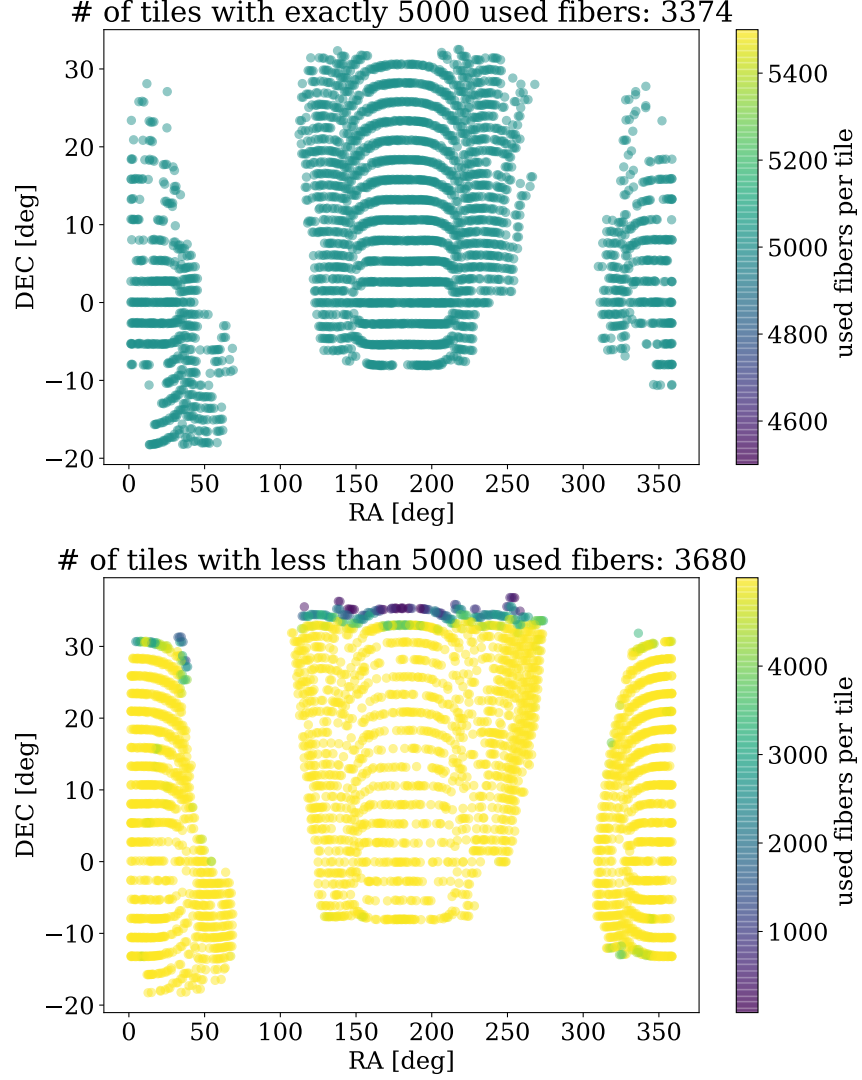

Figure 1: Upper panel: location of the tiles that allocate all 5000 fibers. Lower panel: location of the tiles that use less than 5000 fibers.
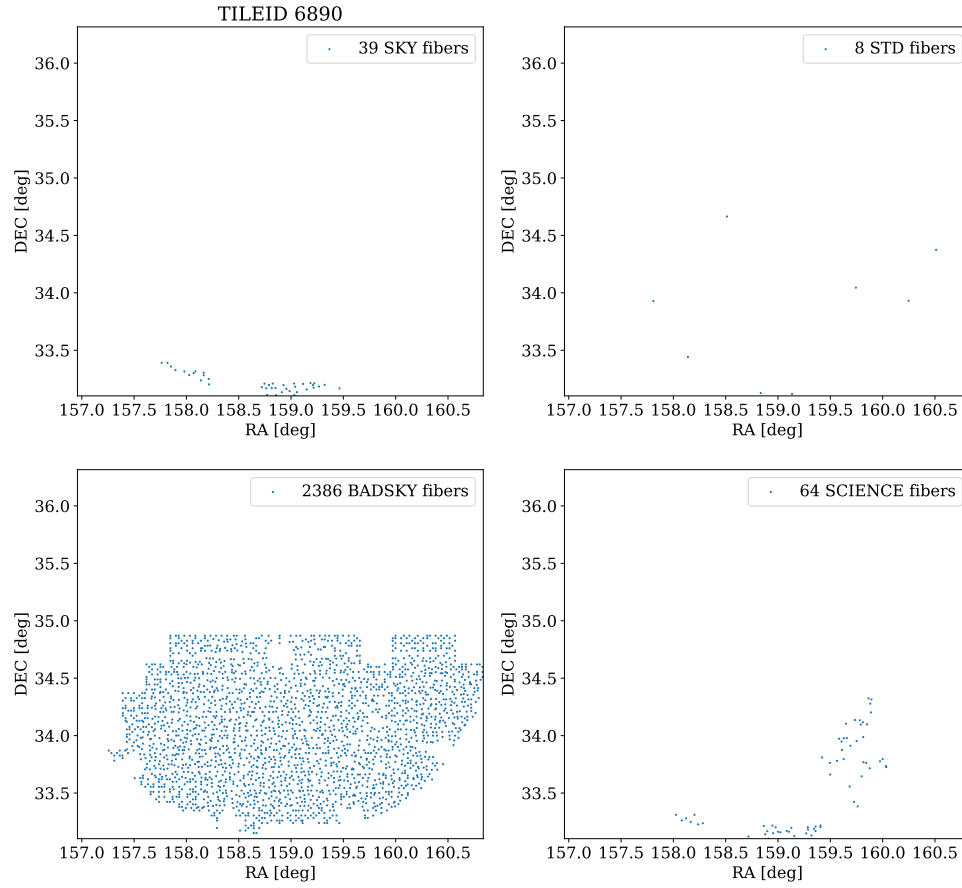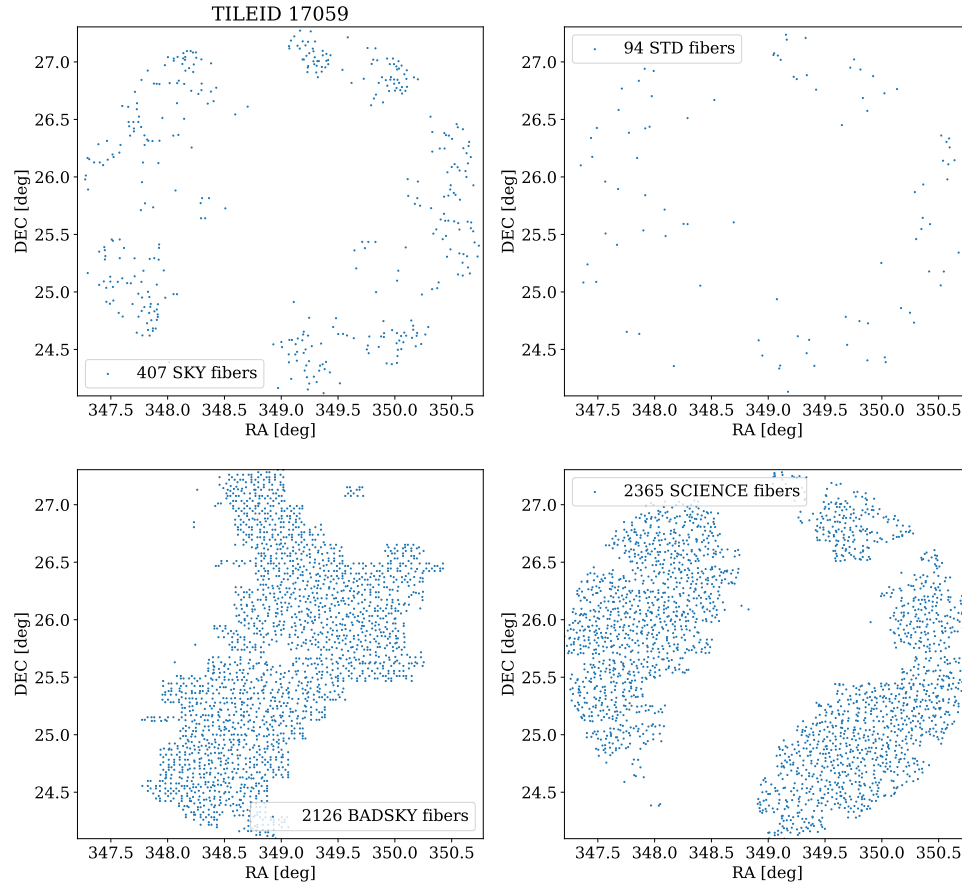
Figure 2: Tile with a low fraction (50%) of used fibers. Each panel shows the different kinds of targets that are assigned. There is a clear lack of targets above 35 degrees of declination.

Figure 3: Tile with a high fraction (99% but not 100%) of used fibers. Each panel shows the different kinds of targets that are assigned. Mostly BADSKY location seems to be available in this region of the sky.
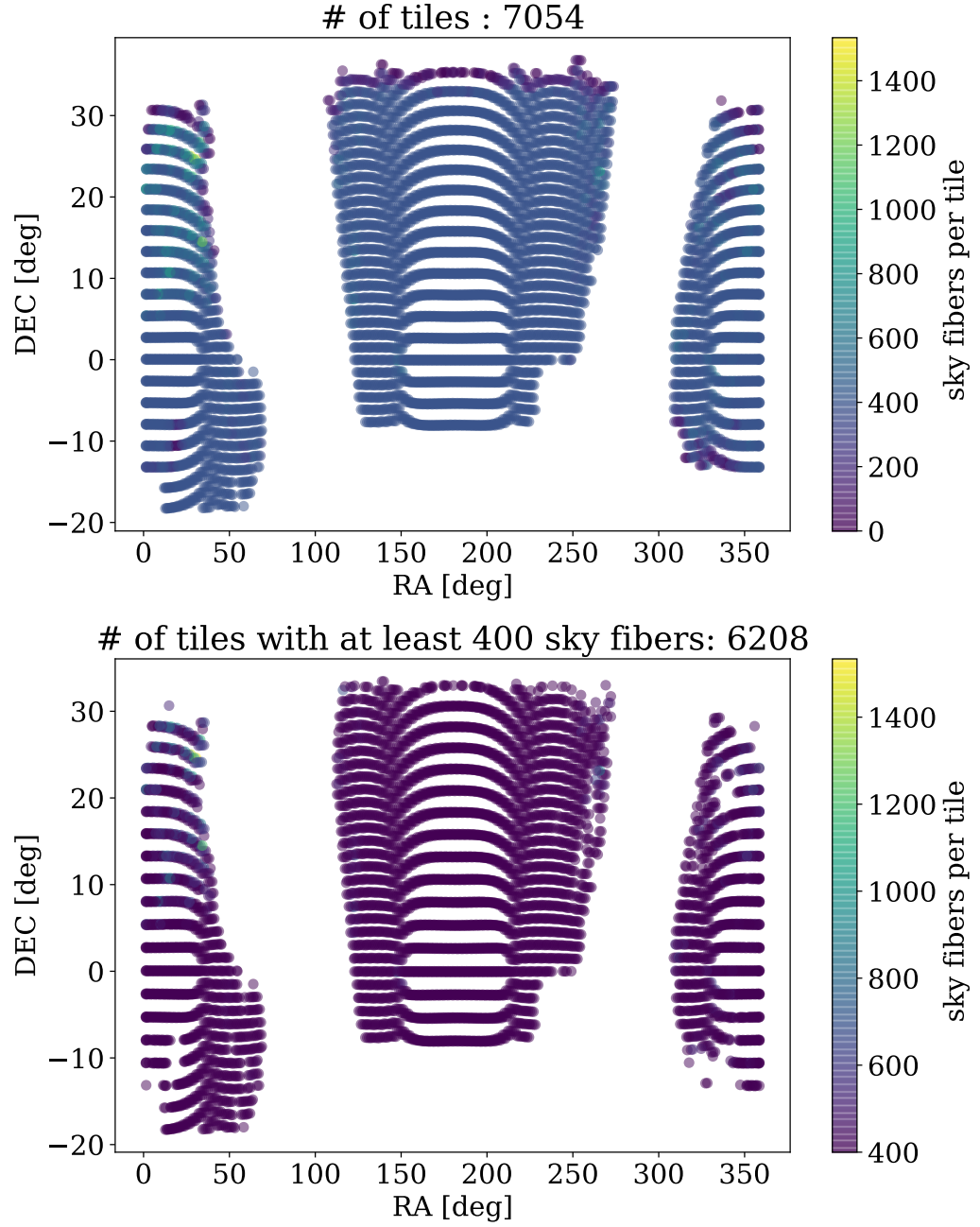
Figure 4: Same as Figure 1, only for SKY fibers. The upper panel shows the sky fibers for all tiles. The lower panel shows the tiles with at least 400 SKY fibers.
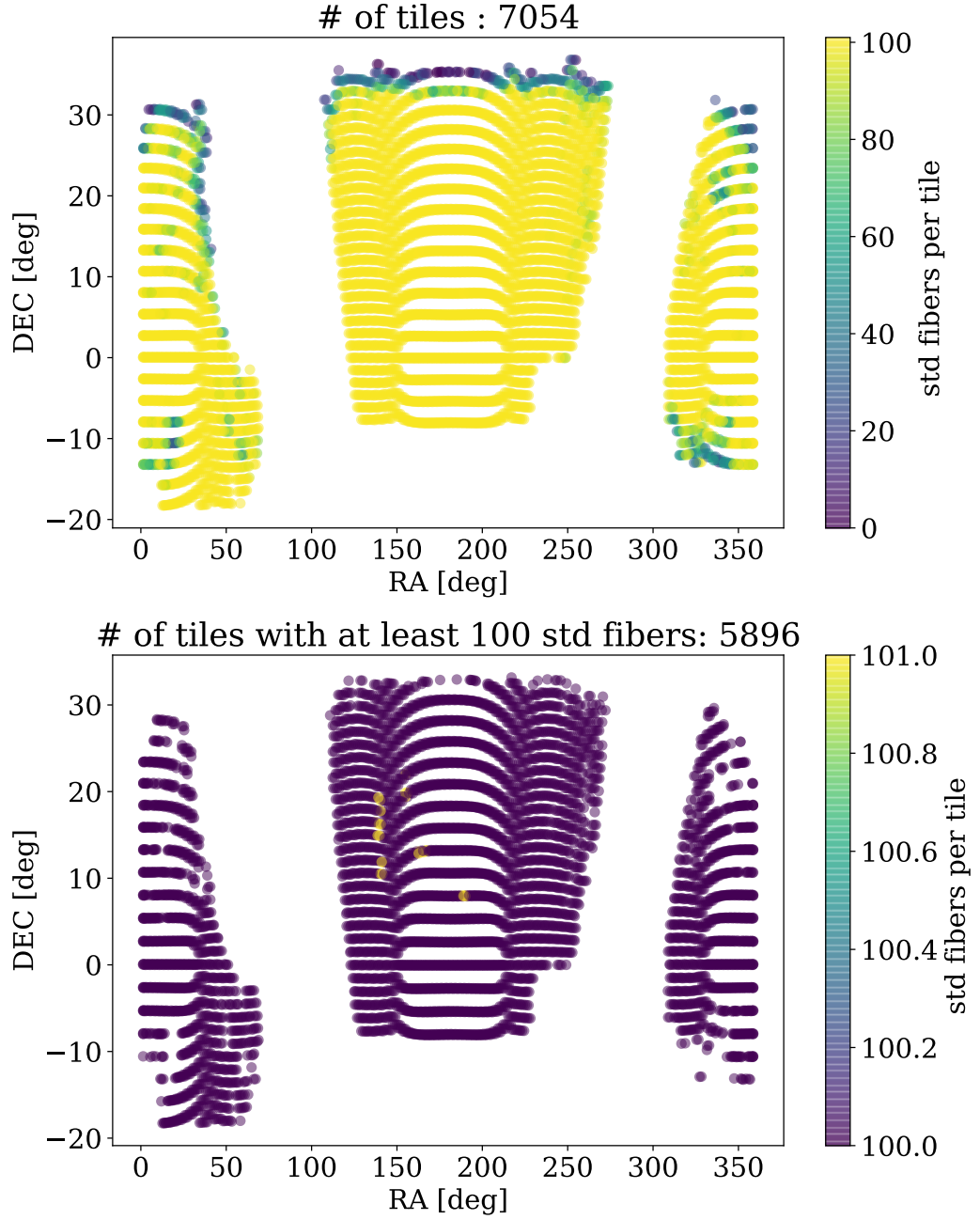
Figure 5: Same as Figure 4, only for STD fibers. The upper panel shows the STD fibers for all tiles. The lower panel shows the tiles with at least 100 STD fibers.
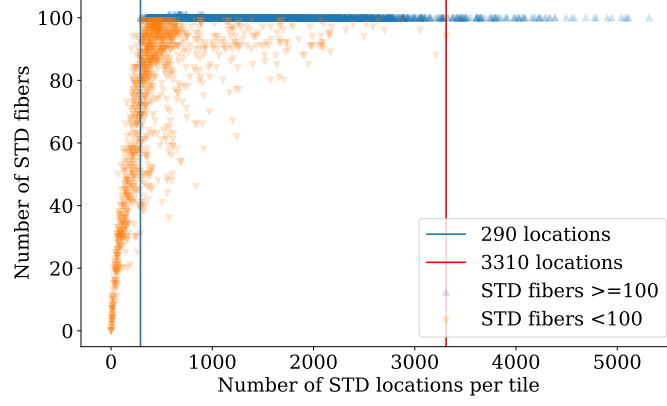
Figure 6: Number of STD fibers as a function of number of STD targets per tile. The blue line indicates the value below which the value of 100 STD targets cannot be met. The red line indicates the value above which the value of 100 STD target can always be met.
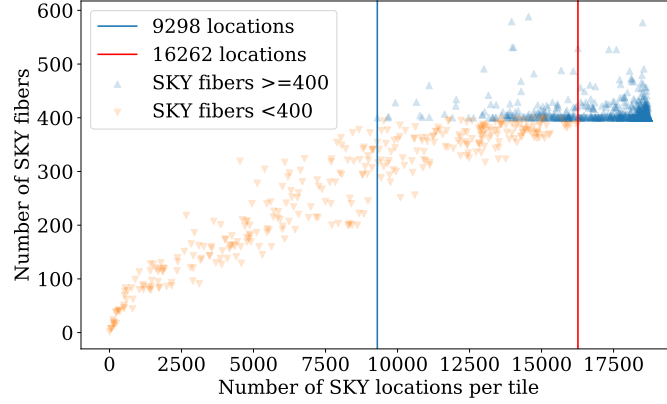

Figure 7: Number of SKY fibers as a function of number of SKY locations per tile. The blue line indicates the value below which the value of 400 SKY locations cannot be met. The red line indicates the value above which the value of 400 SKY locations can always be met.